

IN THE CLAIMS

Claims 1-21 and 41 are pending. Claims 42-45 are added.

1. (original) A chemical reactor comprising:
at least one reaction chamber comprising at least one porous catalyst material and at least one open area wherein each of said at least one reaction chamber has an internal volume defined by reaction chamber walls;
wherein said internal volume has dimensions of chamber height, chamber width and chamber length;
wherein said at least one reaction chamber comprises a chamber height or chamber width that is about 2 mm or less;
wherein, at a point wherein said chamber height or chamber width is about 2 mm or less, said chamber height and said chamber width define a cross-sectional area;
said cross-sectional area comprising a porous catalyst material and an open area, wherein said porous catalyst material occupies 5% to 95% of the cross-sectional area and wherein said open area occupies 5% to 95% of the cross-sectional area;
wherein said open area in said cross-sectional area occupies a contiguous area of 5×10^{-8} to $1 \times 10^{-2} \text{ m}^2$ and wherein said porous catalyst material has a pore volume of 5 to 98 % and more than 20% of the pore volume comprises pores having sizes of from 0.1 to 300 microns.
2. (original) The reactor of claim 1 comprising a bulk flow channel that is contiguous over the length of the reaction chamber.
3. (original) The reactor of claim 2 wherein the bulk flow channel is essentially straight.

4. (original) The reactor of claim 2 comprising 5 to 1000 bulk flow channels.

5. (original) The reactor of claim 1 wherein said porous catalyst material comprises a core of a relatively large pore first material and a coating of a relatively small pore second material disposed over at least a portion of said first material.

6. (original) The reactor of claim 1 comprising at least 5 reaction chambers.

7. (original) The reactor of claim 1 comprising multiple reaction chambers and at least one mixing chamber disposed such that gases from at least two reaction chambers can mix in the at least one mixing chamber.

8. (original) The reactor of claim 2 comprising offsetting porous dividers.

9. (original) The reactor of claim 2 further comprising a microchannel heat exchanger in thermal contact with said reaction chamber.

10. (original) The reactor of claim 2 wherein said porous catalyst material is a discrete unit that can be inserted into or removed from the reaction chamber.

11. (original) The reactor of claim 2 further comprising a gas compartment and a flow distribution layer wherein the flow distribution layer is disposed between the gas compartment and the reaction chamber such that gas can flow from the gas compartment through the flow distribution layer to the reaction

chamber.

12. (original) The reactor of claim 2 further comprising a gas compartment; wherein a porous catalyst material is disposed between said gas compartment and an open area of said reaction chamber.

13. (original) A chemical reactor comprising:
at least one reaction chamber comprising catalyst rods, plates or baffles having a length to thickness ratio of at least 10, and
wherein each of said at least one reaction chamber has an internal volume defined by reaction chamber walls;

wherein said internal volume has dimensions of chamber height, chamber width and chamber length;

wherein said at least one reaction chamber comprises a chamber height or chamber width that is about 2 mm or less; and

wherein said catalyst rods, plates or baffles are disposed in said reaction chamber such that the pressure drop across the reaction chamber is less than 20% of the total system inlet pressure.

14. (original) The reactor of claim 13 wherein said at least one reaction chamber comprises fibers or baffles and said fibers or baffles comprise a porous catalyst material.

15. (original) A chemical reactor comprising:
at least one reaction chamber comprising at least three layers:
a first layer comprising a first porous catalyst material;
a second layer comprising a heat exchanger and at least one fluid flow path through said second layer, said second layer disposed in the reaction chamber such that fluid passing through the first layer can pass through said at least one fluid flow path, and
a third layer comprising a second porous catalyst material said

third layer disposed in the reaction chamber such that fluid passing through the second layer can pass into said second porous catalyst material;

wherein said first layer has contiguous channels having dimensions of channel height, channel width and channel length;

wherein said at least one of said contiguous channel comprises a channel height or channel width that is 0.1 micrometers to about 2 mm;

wherein at least part of said at least one of said contiguous channels comprises said first porous catalyst material; and

wherein said first porous catalyst material has a pore volume of 5 to 98 % and more than 20% of the pore volume comprises pores having sizes of from 0.1 to 300 microns.

16. (original) The reactor of claim 15 wherein said heat exchanger comprises a microchannel heat exchanger.

17. (original) The reactor of claim 16 wherein said at least one of said contiguous channels comprises a channel height or channel width that is 0.3 micrometers to 2 mm; and wherein said third layer layer has contiguous channels having dimensions of channel height, channel width and channel length, wherein at least one of these contiguous channels comprises a channel height or channel width that is 0.3 micrometers to 2 mm.

18. (original) The reactor of claim 17 wherein said at least one fluid flow path comprises a microchannel.

19. (original) The reactor of claim 16 wherein said first layer has an inlet and said third layer has an outlet and further comprising a conduit connecting said outlet to said inlet.

20. (original) The reactor of claim 19 wherein said conduit contains a separating agent.

21. (original) The reactor of claim 17 wherein the porous catalyst material in said first layer comprises a metal foam or felt.

22-40. (canceled)

41. (previously presented) The reactor of claim 16 wherein said at least one fluid flow path through said second layer comprises a reactant stream; and wherein said microchannel heat exchanger comprises a heat exchange fluid; wherein said heat exchange fluid is flowing cross current relative to said reactant stream.

42. (new) The chemical reactor of claim 1 wherein more than 50% of the pore volume comprises pores having sizes of from 0.3 to 200 microns.

43. (new) The chemical reactor of claim 14 wherein said porous catalyst material has a pore volume of 5 to 98 % and more than 50% of the pore volume comprises pores having sizes of from 0.1 to 300 microns.

44. (new) The chemical reactor of claim 43 said at least one reaction chamber comprises baffles and wherein said baffles comprise a thermally conductive metal.

45. (new) The chemical reactor of claim 43 said at least one reaction chamber comprises fibers and wherein said porous catalyst material has a pore volume of 5 to 98 % and more than 50% of the pore volume comprises pores having sizes of from 0.1

to 300 microns.